BOSE MCKINNEY & EVANS LLP

00/90/80 7 - 03-9-00

PC780 U.S. PTO

2700 First Indiana Plaza
135 North Pennsylvania Street
Indianapolis, Indiana 46204

PATENT APPLICATION
Box Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Transmitted herewith for filing under 35 U.S.C. 1.111 and
37 C.F.R. 1.53 is the patent application of:

Applicants: Meek et al.

Title: HEALTHCARE MANAGEMENT SYSTEM AND
                   METHOD OF PREDICTING HIGH UTILIZERS
                   OF HEALTHCARE SERVICES

Atty. Docket No.: 9110-0008

Enclosed are:

x	Specification (32 pages)
x	Claims (20 claims)
x	Drawings (3 sheets)
x	Abstract
x	Declaration and Power of Attorney
x	An assignment of the invention to __The Haelan Corporation__
x	Statement(s) of Status as Small Entity
	Check to cover the total fees for filing this application as calculated below
x	Recordation Form Cover Sheet (in duplicate)
	$40 fee for recording assignment
	Claim of Priority
	Priority Document
	Information Disclosure Statement
	Form PTO-1449
	Copies of _____ Cited References
	Preliminary Amendment
x	Please charge filing and recordation fees to Bose McKinney & Evans LLP Deposit Account No. 02-3223

CLAIMS AS FILED				
	NUMBER FILED	NUMBER EXTRA	RATE	FEE
BASIC FEE (37 C.F.R. 1.16 (a))			$690	$690
TOTAL CLAIMS (37 C.F.R. 1.16(c))	20 - 20 =	* 0	x$18	
INDEPENDENT CLAIMS (37 CFR 1.16(b))	3 - 3 =	* 0	x$78	
MULTIPLE DEPENDENT CLAIM PRESENT	(37 C.F.R. 1.16(d))		$260	
* NUMBER EXTRA MUST BE ZERO OR LARGER			TOTAL	
If applicant has small entity status under 37 C F R. 1.9 and 1.27, then divide total fee by 2, and enter amount here.			SMALL ENTITY TOTAL	$345.00

FEE FOR RECORDING ASSIGNMENT $40.00

TOTAL FEES $385.00

The Commissioner is hereby authorized to charge any additional filing fees under 37 C F R 1 16 or processing fees under 37 C.F.R 1 17 which may be required, or credit any overpayment, to Bose McKinney & Evans LLP's Deposit Account No 02-3223. A duplicate copy of this sheet is enclosed.
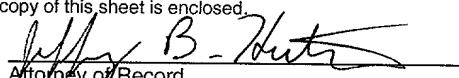
Attorney of Record
Printed Name: Jeffrey B. Huter
Registration No.: 41,806

269293

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group: Application or Patent No.:
Attorney Docket No.: 9110-0008   Filing or Issue Date: Herewith
Applicant or Patentee: Meek et al.
Invention: HEALTHCARE MANAGEMENT SYSTEM AND METHOD OF PREDICTING HIGH UTILITIES OF
       HEALTHCARE SERVICES

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) AND 1.27(c)) - SMALL BUSINESS CONCERN

I hereby declare that I am

    ☐   the owner of the small business concern identified below:

    ☒   an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN_____The Haelan Corporation_____

ADDRESS OF CONCERN___748 E. Bates Street, Suite 103_____

_____Indianapolis, Indiana 46204-4055_____

I hereby declare that the above-identified small business concern qualifies as a small business concern as defined in 13 CFR 121, for purposes of paying reduced fees to the United States Patent and Trademark Office. Questions related to size standards for a small business concern may be directed to: Small Business Administration, Size Standards Staff, 409 Third Street, SW, Washington, DC 20416.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention described in

    ☒   the specification filed herewith with the title as listed above,

    ☐   the application identified above,

    ☐   the patent identified above.

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed below* and no rights to the invention are held by any person, other than the inventor, who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

    *NOTE: Separate statements are required from each named person, concern or organization having rights to the invention declaring their status as small entities. (37 CFR 1.27)

FULL NAME _____

ADDRESS _____

    [ ] INDIVIDUAL   [ ] SMALL BUSINESS CONCERN   [ ] NONPROFIT ORGANIZATION

FULL NAME _____

ADDRESS _____

    [ ] INDIVIDUAL   [ ] SMALL BUSINESS CONCERN   [ ] NONPROFIT ORGANIZATION

FULL NAME _____

ADDRESS _____

    [ ] INDIVIDUAL   [ ] SMALL BUSINESS CONCERN   [ ] NONPROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is not longer appropriate. (37 CFR 1.28(b))

NAME OF PERSON SIGNING ___Julie A. Meek_____

TITLE OF PERSON IF OTHER THAN THE OWNER ____Chief Executive Officer_____

ADDRESS OF PERSON SIGNING ___1925 Fox Moore Terrace_____

_____Greenwood, Indiana 46143_____

SIGNATURE ___Julie A. Meek_____   DATE __3-8-00___

268660

Patent Application

of

Julie A. Meek
1925 Fox Moor Terrace
Greenwood, IN 46143

Brenda L. Lyon
6563 Calais Circle
Indianapolis, IN 46220

and

Wendy D. Lynch
14281 W. Evans Circle
Lakewood, CO 80228

for

Healthcare Management System And Method
Of Predicting High Utilizers Of Healthcare Services

HEALTHCARE MANAGEMENT SYSTEM AND METHOD
OF PREDICTING HIGH UTILIZERS OF HEALTHCARE SERVICES

Field of the Invention

The present invention relates generally to healthcare management systems, and more particularly to a healthcare management system and method for identifying individuals at risk for high near-term healthcare use.

Background of the Invention

In commercial adult managed care populations, typically 10-20% of the population will incur 80-90% of the risk exposure for the risk-bearing payer. A major challenge in today's managed care environment is prospectively predicting which members are at risk for high utilization to enable appropriate targeting of proactive case management and intervention programs. These members could enjoy better health and incur fewer health-related expenses if they could be identified early and managed proactively.

Historically over the last 30 years, health assessment tools for adult populations (18-65 years of age) have been built upon clinical risk/chronic disease models to guide clinical decision making, to serve as outcome measures, or to automate aspects of care such as automated problem lists, laboratory results, and healthcare reminders. The emphasis has been on practical clinical issues, resulting in limited predictive power in terms of targeting those at risk for higher levels of healthcare-seeking behavior.

Increasingly, the ability of risk-bearing payers to approach population health management in a cost and quality-effective manner, will be dependent upon sound predictive models which guide care toward members who have a higher probability of becoming a high care user in the near-term. Adding momentum to the efforts, technological advances such as ASP and dynamic HTML Web tools, widespread connectivity to the Internet, and digital, variable-data print technologies have only recently become available to make population-based care management a real option versus a rhetorical question.

Theoretically and empirically, evidence suggests that near-term healthcare utilization may not be as strongly tied to traditional disease and clinical risk models as once thought. Indeed, 40-60% of office visits are often tied to non-disease based concerns. Also, from a practical perspective, risk/disease models often miss key prescriptive data which may guide the health counseling process (i.e., areas of readiness to change, stress levels, levels of perceived self-management, etc.) and key outcome measures (i.e., improvements in functional

ability, levels of stress emotions, disease and medication compliance, etc.). In a practical sense, claims-based stratification methods are limited by the inherent inadequacies of the claims data itself, including the lack of claims history from new enrollees and the several month time lags often required to access and process the predictive information.

Therefore, a need exists for a healthcare management system and method that identify, based upon easily ascertained self-reported information, those members of a managed healthcare group who are at risk for high near-term healthcare use

Summary of the Invention

The present invention addresses the above-identified need, as well as others, with a method of managing healthcare services. On step of the method includes collecting information from an individual for a predetermined set of predictive factors. Another step of the method includes assigning, based upon the information from the individual, a separate value to each predictive factor of the predetermined set of predictive factors. The method further includes the step of generating, based upon a predetermined predictive model and the separate values assigned to the predetermined set of predictive factors, a risk level of the individual utilizing healthcare services at a predetermined level within a prospective time span.

Pursuant to another embodiment of the present invention, there is provided a healthcare management system including a processor, and a memory operably coupled to the processor. The memory includes instructions that, when executed by the processor, cause the processor to assign, based upon information from an individual, a separate value to each predictive factor of a set of predictive factors. The instructions of the memory, when executed by the processor, further cause the processor to generate, based upon a predetermined predictive model and the separate values assigned to the predetermined set of predictive factors, a risk level of the individual utilizing healthcare services at a predetermined level within a prospective time span.

Pursuant to a further embodiment of the present invention, there is provided a computer readable medium for a healthcare management system. The computer readable medium including instructions that, when executed by the healthcare management system, cause the healthcare management system to assign, based upon information from an individual, a separate value to each predictive factor of a set of predictive factors. The instructions, when executed by the healthcare management system, further cause the

healthcare management system to generate, based upon a predetermined predictive model and the separate values assigned to the predetermined set of predictive factors, a risk level of the individual utilizing healthcare services at a predetermined level within a prospective time span.

It is an object of the present invention to provide an improved healthcare management system and method.

It is also an object of the present invention to provide a new and useful healthcare management system and method.

It is another object of the present invention to provide a healthcare management system and method for identifying high risk individual users of healthcare services.

It is yet another object of the present invention to provide a computer readable medium for configuring a healthcare management system to identify individuals at risk of high near-term healthcare use.

It is yet another object of the present invention to provide a healthcare management system and method for identifying members of a managed care group who are at risk to utilize healthcare services at a predetermined usage rate within prospective time span.

The above and other objects, features, and advantages of the present invention will become apparent from the following description and the attached drawings.

Brief Description of the Drawings

FIG. 1 is a simplified block diagram of an exemplary healthcare management system which incorporates various features of the present invention;

FIG. 2 illustrates an exemplary operating environment in which the healthcare management system of FIG. 1 may be utilized; and

FIG. 3 is a flowchart depicting the general operation of the healthcare managment system of FIG. 1.

Description of Exemplary Embodiments

While the invention is susceptible to various modifications and alternative forms, exemplary embodiments thereof have been shown by way of example in the drawings and will herein be described in detail. It should be understood, however, that there is no intent to limit the invention to the particular forms disclosed, but on the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the

invention as defined by the appended claims.

Referring now to FIG. 1, a simplified block diagram of an exemplary healthcare management system ("HMS") 100 is shown which incorporates various features of the present invention. As will be explained in more detail, the exemplary HMS 100 is generally operable to identify members (i.e. individuals), based upon perceived health information, who are at risk of high near-term healthcare use. Besides identifying members of the managed care group who are at risk for high near-term healthcare use, the HMS 100 enables proactive case management of the identified members. For example, the HMS 100 enables healthcare managers identify individuals who are at risk of incurring significant healthcare expenses in the near-term so that intervention programs may be targeted to these identified individuals in order to help these individuals to enjoy better health and to incur fewer health-related expenses.

To this end, the exemplary HMS 100 includes a processor 102, memory 104, a system bus 106, controllers 112, 114, 116, 118, network interface 120, and devices 122, 124, 126, 128. The hardware architecture of the exemplary HMS 100 is generally illustrative of general purpose computing systems such as personal computers, workstations, and servers currently manufactured by Gateway, Dell, Macintosh, Sun Microsystems, and IBM. While the hardware architecture of the exemplary HMS 100 is generally illustrative of general purpose computing systems, the HMS 100 may also be implemented as a special purpose computing device that is generally operable to perform a limited set of tasks associated with healthcare management.

Returning to the description of the exemplary HMS 100, the processor 102 includes one or more processing units such as the central processing units of Intel, AMD, IBM, National Semiconductor, and Transmeta. The processor 102 is generally operable to execute software and/or firmware routines stored in the memory 104. As a result of executing the software and/or firmware routines of the memory 104, the processor 102 controls the general operation of the HMS 100 and the devices 122, 124, 126, 128 via the respective controllers 112, 114, 116, 118. Moreover, the processor 102 as a result of executing software and/or firmware routines of the memory 104 is generally operable to implement a predictive model that identifies, based upon perceived health, members of a managed care group who are at risk of high near-term healthcare use.

The memory 104 of the exemplary HMS 100 is operable to store data and code used by the processor 102. To this end, the memory 104, in an exemplary embodiment, includes

standard random access memory for storing the data and software code needed by the processor 102. However, the memory 104 may alternatively include other volatile memory types such as DRAM, SDRAM, and SRAM for storing data and software code and/or non-volatile memory such as ROMs, PROMs, EEPROMs, and flash memory for storing data and firmware code.

The system bus 106 is generally operable to interconnect the processor 102, the memory 104, and the controllers 112, 114, 116, 118. To this end, the system bus 106 in the exemplary embodiment includes an address bus and data bus which enable the various components of the exemplary HMS 100 to communicate with one another.

The removable media drive 122 is generally operable to read information from and write information to the removable storage medium 150, and the removable storage media controller 112 is generally operable to provide the processor 102 with an interface to the removable media drive 122. The removable media drive 122 may include various computer readable and/or writeable storage media devices such as floppy disk drives, DVD drives, tape drives, DAT drives, and ZIP drives in order to access corresponding types of removable storage media. The removable media drive 122 may also include non-volatile memory interfaces for accessing non-volatile memory devices such as PROMS, EEPROMS, and Flash Memory.

The mass storage device 124 is generally operable to store data and/or software code of the exemplary HMS 100, and the mass storage controller 114 is generally operable to provide the processor 102 with an interface to the data and/or software code stored by the mass storage device 118. To this end, the mass storage device 118 may include various computer readable and/or writeable media devices such as hard disk drives, floppy disk drives, CD-ROM drives, DVD-RAM drives, RAID devices, and/or Disk-On Chip devices to name a few. The HMS 100 may alternatively be implemented without a mass storage device 122 and mass storage controller 112. For example, the exemplary HMS 100 may be implemented with data and firmware code stored in a non-volatile manner in the memory 104.

The video display device 126 is operable to provide a visual display to a user of the exemplary HMS 100, and the video controller 116 is operable to provide the processor 102 with an interface to the video display device 126. To this end, the video display device 126 may include CRT displays, LCD displays, and/or standard television displays. The HMS 100 may alternatively be implemented without a video display device 126, and video controller

116. For example, the HMS 100 may be implemented to output results to an attached printer (not shown), the removable storage media 150, and/or another computing device attached to the HMS 100 via the network interface 120, a USB port (not shown), parallel port (not shown), or FireWire interface (not shown).

The input device 128 is operable to provide a user of the exemplary HMS 100 with an interface to control the operation of the exemplary HMS 100 and/or to provide the exemplary HMS 100 with information. Moreover, the I/O interface controller 118 is operable to provide the processor 102 with an interface to the input device 128. To this end, the input device may include a mouse, keyboard, touch pad, push buttons, touch screen, and/or digital scanner.

The network interface 120 is generally operable to couple the exemplary HMS 100 to a network such as the Internet, an intranet, and/or an extranet. The network interface 120 generally enables the exemplary HMS 100 to send and receive information to and from other computing devices coupled to the network. To this end, the network interface 120 may be implemented with a network interface card such as an Ethernet card or Token Ring card. The network interface 120 may also be implemented with an analog modem for use over POTS telephone lines such as a 28.8K or 56K modem. The network interface 120 may also be implemented with a digital modem such as a cable modem for use over a cable distribution network, an ISDN modem for use over an ISDN telephone line, or a DSL modem for use over a POTS telephone lines that support DSL.

An exemplary operating environment is illustrated in FIG. 2. As illustrated, the HMS 100 is operably coupled to client computing devices 202_1, 202_2 ... 202_X via a network 200. The network 200 may include multiple public or private LANs and/or WANs that are operably coupled to one another via routers, switches, hubs, gateways, proxies, and/or firewalls. In an exemplary embodiment, the network interface 120 of the HMS 100 is operably coupled to a LAN that provides a gateway to the Internet. As a result, the exemplary HMS 100 is accessible to client computing devices 202_1, 202_2 ... 202_X that are either coupled to the LAN or the Internet, thus providing the services of the HMS 100 to people located locally and throughout the world.

In an exemplary embodiment, the HMS 100 communicates with client computing devices 202_1, 202_2 ... 202_X in accordance with the Hyper Text Transport Protocol (HTTP) and other Internet Protocols (IP). Accordingly, the services of the HMS 100 are generally available to any client computing device that supports the appropriate IP protocols. Most personal computers such as those manufactured by Dell and MacIntosh include web browsing

software that provide an interface to services delivered via the IP protocols. However, besides personal computers, many other devices are being developed that include web browsing capabilities. For example, set-top boxes such as Microsoft's WebTV and certain digital mobile phones include web browsing capabilities and could be used to access the services of the HMS 100.

As stated above, the HMS 100 identifies individuals who are at risk of high near-term healthcare use based upon perceived health information and other information. Perceived health is defined as a person's composite evaluation of how he or she is feeling and doing. People experience health as either some level of wellness or illness. If a person is experiencing unpleasant or uncomfortable physical sensations and/or emotions in addition to not functioning up to their perceived capability level, the person perceives some level of illness. Some degree of wellness, on the other hand, is perceived when the person experiences pleasant/comfortable physical sensations and emotions combined with an acceptable level of self-evaluated functioning.

The difference between the perceived health and disease/risk models is that a person can experience wellness in the presence or absence of disease. For example, a person who has diabetes can experience wellness in that from the persons's perspective the person is feeling and doing well. Conversely, a person can experience illness in the absence of discernable disease in that from the person's perspective the person is not feeling nor doing well. From a practical viewpoint, people seek care when their sense of feeling and doing is below their perceived threshold of tolerance.

Evidence also shows a correlation between (i) an individual's beliefs and preferences regarding the healthcare system and (ii) particular types of healthcare-seeking behavior. In particular, individuals who place high levels of faith in the healthcare system or desire the input of health professionals to make health decisions tend to use the healthcare system more often.

As a result of the above observed correlations, the exemplary HMS 100 attempts to identify individuals at risk of high near-term healthcare use based upon information about an individual's perceived health, beliefs and preferences regarding the healthcare system, past levels of healthcare use, and demographics. To this end, the HMS 100 in step 310 of FIG. 3 obtains such information from an individual via a health perception questionnaire. An exemplary questionnaire is provided in Appendix A and includes questions that elicit information for a predetermined set of predictive factors which include past healthcare use

factors, demographic factors, perceived health factors, disease factors, healthcare compliance factors, healthcare belief factors, and healthcare preference factors.

The exemplary HMS 100 is operable to display the health perception questionnaire on the video display 126 and receives responses to the questions of the questionnaire via the input device 128. Moreover, the exemplary HMS 100 is further operable to transmit the questionnaire to client computing devices 202_1, 202_2 ... 202_X via the network 200, and receives responses to the questions of the questionnaire from client computing devices 202_1, 202_2 ... 202_X via the network 200. The HMS 100 may also include various other mechanisms for receiving responses to the health perception questionnaire. For example, the HMS 100 may include a digital scanner that is operable to read from a printed questionnaire an individual's responses to the questions of the questionnaire. The HMS 100 may also obtain responses to the questionnaire from archived information stored on a removable medium 150, the mass storage device 124, or a database accessible via the network 200. Further yet, them HMS 100 may obtain responses to the questionnaire via telephone (e.g. an interactive voice response telephone system).

After obtaining information from an individual, the exemplary HMS 100 analyzes the information based upon a predictive model developed from similar information collected from other individuals and their prospective use of healthcare services. As will be explained in more detail below, the exemplary HMS 100 analyzes the information based upon a logistic regression predictive model represented by the following equations:

$$z = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 \ldots \beta_{38} X_{38} + \beta_{39} X_1 X_2 + C,$$

$$P_{high\_use} = e^z / (1 + e^z)$$

where β_1, β_2, β_3, β_4 ... β_{39} represent the regression coefficient shown in Table 2 of Appendix B; X_1, X_2, X_3, X_4 ... X_{38} represent the predictor variables shown in the questionnaire of Appendix A and Table 2 of Appendix B; and C represents the regression constant shown in Table 2 of Appendix B. Those skilled in the art should appreciate that predictor variables X_1 and X_2 are interaction variables. Moreover, other analysis tools such as neural networks, genetic algorithms, and fuzzy logic could also be used to develop the predictive model.

In order to utilize the above logistic regression predictive model, the exemplary HMS 100 in step 330 processes an individual's responses to the health perception questionnaire in order to obtain suitable values for the predictor variables X_1, X_2, X_3, X_4 ...X_{38}. More specifically, the predictor variables X_1, X_2, X_3, X_4 ...X_{38} of the logistic regression are converted to dichotomous variables (i.e. variables that can have one of only two values such as 0 or 1).

Accordingly, the exemplary HMS 100 assigns an appropriate dichotomous value to each of the predictor variables X_1, X_2, X_3, X_4 ...X_{38} based upon the responses to the health perception questionnaire. In the exemplary embodiment, the HMS 100 generally assigns a first dichotomous value of "0" to each variable X_1, X_2, X_3, X_4 ... X_{38} that the responses suggest are not indicative of the individual being at risk of high near-term healthcare use, and assigns a second dichotomous value of "1" to each variable X_1, X_2, X_3, X_4 ...X_{38} that the responses suggest are indicative of the individual being at risk of high near-term healthcare use. Table 2 of Appendix B illustrates the possible responses to the questionnaire for each predictive variable and corresponding dichotomous value assigned to the predictive variable X_1, X_2, X_3, X_4 ...X_{38}. Moreover, for each variable each variable X_1, X_2, X_3, X_4 ...X_{38} corresponding to an answered or an inappropriately answered question, the exemplary HMS 100 assigns the variable a value of "0" in order to be conservative in identifying individuals as high near-term users of healthcare services.

After assigning a dichotomous value to each of the predictor variables X_1, X_2, X_3, X_4 ... X_{38}, the HMS 100 in step 340 calculates, based upon the above logistic regression equations, a value indicative of whether the individual is at risk of high near-term healthcare use. Essentially, the exemplary HMS 100 in step 340 obtains for the individual a probability value, ranging between 0 and 1, that is indicative of the probability that the individual is a high-risk for high near-term healthcare use.

The HMS 100 then in step 350 determines based upon the probability value obtained for the individual in step 340 whether the individual should be identified as a high-risk or a low-risk person. In particular, the exemplary HMS 100 makes such a determination by comparing the obtained probability value to a predetermined threshold value. The threshold value is preselected to strike a balance between sensitivity and specificity of the measurement. Sensitivity is defined as the percent of people who become high care users and are so identified prospectively by the predictive formula. Specificity is defined as the percent of people who do not become high care users and are so identified by the formula. From a practical viewpoint, the threshold value may also be selected dependent upon the sponsoring plan's objectives, intervention capacity, financial parameters, and expectations. The exemplary HMS 100 utilizes a threshold value of 0.47 and identifies any individual with a probability value greater than the threshold value as a high-risk of high near-term healthcare use. Furthermore, besides identifying an individual as a high-risk if their associated probability value P_{high_user} exceeds the threshold value, the exemplary HMS 100 also marks an

individual as a high risk if the individual fails to answer or incorrectly answers more than a predetermined number of questions.

The HMS 100 in step 360 outputs the results of the analysis. In particular, the exemplary HMS 100 is operable to display output results on video display 126 or transmit the output results to a client computing device 202_1, 202_2 ... 202_x for display. In the exemplary embodiment, the HMS 100 is operable to generate several types of reports and restrict the generation of certain reports to authorized personnel. For example, a member of the managed care group (i.e. an individual responding to the health perception questionnaire) may cause the HMS 100 to generate reports which (i) provide a general health report, (ii) advise as to how the individual may improve their overall health, (iii) provide information about appropriate intervention programs, and (iv) provide follow-up coaching reports from care providers. On the other hand, personnel of a managed care group may cause the HMS 100 to later generate similar reports about the above identified member and additional reports that (i) summarize the wellness of the managed care group, (ii) list individuals identified as high risk, and (iii) identify intervention programs which address wellness needs of the managed care group.

Development and Validation of the Exemplary Predictive Model

The predictive model of the exemplary HMS 100 was developed from an initial member population of 20,000 members ages 18-65 with claims data showing more than 6 primary care visits within the last year. A health perception questionnaire containing 70 question/126 response was mailed to the 20,000 members. Subsequently, for the 5,285 members who responded, claims data were obtained from the health plan for the next six months yielding 4,271 members who responded to the health perception questionnaire and were also continuously enrolled during the entire study time period. Those members who completed an intervention program targeted to high utilizers (N=61) were removed from subsequent analyses, leaving 4,210 for the final sample. The sample included 3 female respondents for every male respondent. To assure that the predictive model was developed for a gender-representative population, cases were weighted (3:1) to approximate the normal gender distribution of 51.2% female to 48.8% male. Both the original and weighted sample descriptives are listed in Table 1 of Appendix B.

As indicated above, logistic regression was selected for developing the predictive model; however, other analysis tools such as neural networks, genetic algorithms, and fuzzy

logic could also be used to develop the predictive model. Logistic regression is especially suited for highly skewed data such as the six-month claims encounter data. For this reason, members confirmed as outliers in terms of six-month total dollars or encounters were left in the data set, because the conversion to a dichotomous variable mitigates the outlier effect.

To prepare all questionnaire information for logistic analysis, each survey item of the questionnaire was converted to a dichotomous variable with a value of "0" indicating low-risk and a value of "1" indicating high-risk responses for each item. In cases where item responses could not be conceptually categorized as high-risk versus low-risk, analyses were run comparing responses with subsequent care use to determine the final coding. All missing survey item data (<10% on each variable) was coded as "0" to be conservative.

"Total encounters" over the subsequent six-month period was chosen as the dependent variable. An encounter was defined as a unique person with a unique provider on a unique date. Thus for example, if a person went to their physician, was subsequently sent to a lab and finally to pick up a prescription, the total encounters would equal three. With the impact of DRG's on hospital stays and the increasing movement of services to the outpatient and office settings, this definition of encounters was felt to more accurately represent total healthcare use with accompanying total dollars.

The decision to dichotomize the dependent variable, essentially deciding where to mark the cut-off for a high (1) versus low (0) care user, was a more difficult challenge. A practical rule was used that compares the percent of the population with the percent of premium dollar used. What seems to occur with regularity across adult commercial populations is that the top 2% of care users utilize 40% of the premium, the next 18% of high care users utilize the next 40% of the premium; the next 65% of the members will use the remaining 20% of the premium and 15% of the population will have no care use within the given year. The total member population for the health plan at that time was 36,354 people.

The sample population was ranked from highest to lowest based upon total claims dollars, and each segment of the above identified segments were then weighted until the population reached 36,354. Subsequently, the resulting data set was checked to assure that the percentage of the population coincided with the percent of premium dollar used. Using this method, 3.6% of the extrapolated population used the first 40% of the premium and 22.3% used the next 40% of the premium. By observing the mean, median and range of encounters for this combined 25.9% group versus all others in the population, the dependent variable cut-off was determined to be 6 or greater encounters in a six month period as the

high-risk group coded as "1".

After the dependent variable and all of the potential predictor variables were coded with dichotomous values, logistic regression was applied using all perceived health, risk, disease, compliance, belief/preference and demographic variables. A split-half technique was used where the predictive model is developed on a randomly selected first half of the data set (N=2,067) and then tested for its stability on the second half of the population (N=2,143). Using standard logistic regression on the first split-half of the weighted sample, 50 variables were found to have significance levels at .25 or less including 3 interaction variables in the initial analysis. Subsequent to this initial analysis, a forward stepwise regression was run using these 50 variables on the first split-half, with 39 variables entering the equation. The results of the forward stepwise logistic regression of the probability of becoming a high encounter member using the 39 final predictor variables on the first split-half are shown in Table 2 of Appendix B. The obtained logistic model correctly predicted 68.08% of the observed high care use group and 61.93% of the observed low care use group.

Next, the predictive model was converted to a formula, which could be used to test the first and second split-halves. First, the formula calculates each person's probability (P_{high_use}) of becoming a high care user by inserting his or her responses to the 39-predictor variables into the logistic formula:

$$z = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 \ldots \beta_{38} X_{38} + \beta_{39} X_1 X_2 + C,$$

$$P_{high\_use} = e^z / (1 + e^z)$$

where β_1, β_2, β_3, β_4 ... β_{39} represent the regression coefficient shown in Table 2 of Appendix B; X_1, X_2, X_3, X_4 ... X_{38} represent the predictor variables shown in the questionnaire of Appendix A and Table 2 of Appendix B; and C represents the regression constant shown in Table 2 of Appendix B.

Next, the member is predicted to be high-risk or low-risk according to whether his or her resulting probability value P_{high_use} exceeds a threshold value that is determined a priori. The threshold value was selected to strike the optimal balance between the sensitivity and specificity of the measure. The probability values for the entire weighted respondent population ranged from .06 to .99 with a mean of .53, median of .52 and a standard deviation of .18. Various threshold values were evaluated for their efficacy using these parameters resulting in a selection of .47 as the final probability threshold value. This resulted in 59.9% of the entire weighted respondent population classified as high-risk, which when extrapolated to the entire population equaled approximately 6.9% of the total member population. This

confirms, as stated previously, that the study sample had a disproportionate number of past and subsequent high care utilizers.

To test the predictive validity of the predictive model and the HMS 100, the formula was tested on both halves of the population with the Chi Square test using predicted (0,1) vs. observed (0,1) care use groups. In the first split-half (see Table 3 of Appendix B), the formula resulted in 72.5% (sensitivity) of the high-risk group predicted correctly and 52.7% (specificity) of the low-risk group. Positive predictive value was 63.5% and negative predictive value was 62.9%. In the second split-half, the formula resulted in 64.2% (sensitivity) of the high-risk group predicted correctly and 46.7% (specificity) of the low-risk group. Positive predictive value was 57.3% and negative predictive value was 53.9%.

For the total weighted population, the predicted high-risk members have significantly higher encounters and dollars than the low-risk group as detailed in Table 4. High-risk group average encounters exceeded the low-risk group by nearly 3 encounters as well as an average of $301 more in average care use dollars. Reduction in these dollars by even a net 25% through proactive intervention would have netted this health plan conservatively a half million dollars annually.

Moreover, the selection of .47 for the probability threshold value resulted in approximately 7% of the study population potentially needing prospective health advocacy. Accordingly, the health perception questionnaire and the HMS 100 are effective in identifying individuals at high risk for future high near-term care use without placing an exorbitant burden upon proactive case managers.

To test the health perception model of the exemplary HMS 100 against more traditional stratification methods, a logistic model was developed which used merely traditional predictor variables. The predictor variables used were previous hospitalization in the last six months, age, and presence of a chronic disease. At a probability threshold value of .56, sensitivity was 60.1% and specificity was 51.1%. Results showed that compared to the traditional method of identifying high-risk members, the health perception model of the exemplary HMS 100 added 12.4% to the sensitivity and 1.6% to the specificity in the first split-half, thus contributing considerable predictive power. In addition, because the exemplary HMS 100 uses self-reported information versus claims data, the time lag from assessment to intervention is shortened from several months to less than 24 hours from the initiation of data collection. Care providers also are not subsequently required to complete an additional health assessment, because the exemplary HMS 100 provides prescriptive as well

as predictive information to guide health-counseling efforts.

While the invention has been illustrated and described in detail in the drawings and foregoing description, such illustration and description is to be considered as exemplary and not restrictive in character, it being understood that only exemplary embodiments have been shown and described and that all changes and modifications that come within the spirit of the invention are desired to be protected.

What is claimed is:

1.   A method of managing healthcare services, comprising the steps of:

    collecting information from an individual for a predetermined set of predictive factors;

    assigning, based upon said information from said individual, a separate value to each predictive factor of said predetermined set of predictive factors;

    generating, based upon a predetermined predictive model and said separate values assigned to said predetermined set of predictive factors, a risk level of said individual utilizing healthcare services at a predetermined level within a prospective time span.

2.   The method of claim 1, wherein said collecting step comprises the step of:

    presenting said individual with a self assessment questionnaire designed to elicit said information from said individual for said predetermined set of predictive factors.

3.   The method of claim 1, wherein said collecting step comprises the step of:

    presenting said individual with a questionnaire designed to elicit said information from said individual for said predetermined set of predictive factors, said predetermined set of predictive factors consisting of past healthcare use factors, demographic factors, perceived health factors, disease factors, healthcare compliance factors, healthcare belief factors, healthcare preference factors.

4.   The method of claim 1, wherein said collecting step comprises the step of:

    presenting, to a web browser, a questionnaire that elicits said information from said individual for said predetermined set of predictive factors;

    receiving, via said web browser, said information for said predetermined set of predictive factors in response to said presenting step.

5.   The method of claim 1, wherein said assigning step comprises the steps of:

    determining, based upon said information, whether said first predictor factor is indicative of a high risk of said individual utilizing said healthcare services at said predetermined level within said prospective time span;

5   assigning, based upon said information, a first dichotomous value to said separate

6   value for said first predictive factor in response to said determining step

7   determining that said first predictor factor is indicative of said high risk of said

8   individual utilizing said healthcare services at said predetermined level within said

9   prospective time span; and

10   assigning, based upon said information, a second dichotomous value to said separate

11   value for said first predictive factor in response to said determining step

12   determining that said first predictor factor is not indicative of said high risk of said

13   individual utilizing said healthcare services at said predetermined level within said

14   prospective time span.

1   6.   The method of claim 1, wherein said assigining step comprises the steps of:

2   determining, based upon said information, whether each predictive factor of said set

3   of predictive factors is indicative of a high risk of said individual utilizing said

4   healthcare services at said predetermined level within said prospective time span;

5   assigning, based upon said information, a separate first dichotomous value to each

6   said separate value of each predictive factor of said set of predictive factors that

7   said determining step determines is indicative of said high risk of said individual

8   utilizing said healthcare services at said predetermined level within said

9   prospective time span; and

10   assigning, based upon said information, a separate second dichotomous value to each

11   said separate value of each predictive factor of said set of predictive factors that

12   said determining step determines is not indicative of said high risk of said

13   individual utilizing said healthcare services at said predetermined level within said

14   prospective time span.

1   7.   The method of claim 1, wherein said assigning step comprises the steps of:

2   determining, based upon said information, whether each predictive factor of said set

3   of predictive factors is indicative of a high risk of said individual utilizing said

4   healthcare services at said predetermined level within said prospective time span;

5   assigning, based upon said information, a "1" to each said separate value for each

6   predictive factor of said set of predictive factors that said determining step

7   determines is indicative of said high risk of said individual utilizing said

8   healthcare services at said predetermined level within said prospective time span;

9   and

10   assigning, based upon said information, a "0" to each said separate value for each

11   predictive factor of said set of predictive factors that said determining step

12   determines is not indicative of said high risk of said individual utilizing said

13   healthcare services at said predetermined level within said prospective time span.

1   8.   The method of claim 1, further comprising the steps of:

2   determining, based upon said risk level for said individual, whether a high risk exists

3   that said individual utilizing said healthcare services at said predetermined level

4   within said prospective time span;

5   determining, based upon said information from said individual, at least one

6   intervention program for said individual in response to said determining step

7   determining that said high risk exists that said individual utilizing said healthcare

8   services at said predetermined level within said prospective time span.

1   9.   The method of claim 1, wherein said generating step comprises the step of:

2   generating, based upon said separate values assigned to said set of predictive factors

3   and a logistic regression formula of said predictive model, said risk level of said

4   individual utilizing said healthcare services at said predetermined level within said

5   prospective time span.

1   10. The method of claim 1, wherein said generating step comprises the step of:

2   generating, based upon said separate values assigned to said set of predictive factors

3   and a logistic regression formula of said predictive model, a probability value

4   indicative of said risk level of said individual utilizing said healthcare services at

5   said predetermined level within said prospective time span; and

6   determining, based upon said probability value and a predetermined threshold, said

7   risk level of said individual utilizing said healthcare services at said predetermined

8   level within said prospective time span.

1   11. A healthcare management system, comprising:

2   a processor, and

3   memory operably coupled to said processor, said memory comprising a plurality of

4   instructions that when executed by said processor cause said processor to

5   assign, based upon information from an individual, a separate value to each

6   predictive factor of a set of predictive factors, and

7   generate, based upon a predetermined predictive model and said separate

8   values assigned to said predetermined set of predictive factors, a risk

9   level of said individual utilizing healthcare services at a predetermined

10   level within a prospective time span.

1   12. The healthcare management system of claim 11, further comprising a display device and

2   an input device operably coupled to said processor, wherein said plurality of instructions of

3   said memory, when executed by said processor, further cause said processor to

4   display, upon said display device, a self assessment questionnaire designed to elicit

5   said information from said individual, and

6   receive said information from said individual via said input device in response to

7   displaying said self assessment questionnaire.

1   13. The healthcare management system of claim 11, further comprising a network interface

2   operably coupled to said processor, wherein said plurality of instructions of said memory,

3   when executed by said processor, further cause said processor to

4   transmit, to a web browser via said network interface, a questionnaire designed to

5   elicit said information from said individual, and

6   receive, via said web browser and said network interface, said information from said

7   individual in response to transmitting said questionnaire.

1   14. The healthcare management system of claim 11, wherein said plurality of instructions of

2   said memory, when executed by said processor, further cause said processor to

3   determine, based upon said risk level for said individual, whether a high risk exists

4   that said individual utilizing said healthcare services at said predetermined level

5   within said prospective time span, and

6   determine, based upon said information from said individual, at least one intervention

7   program for said individual in response to determining said high risk exists that

8   said individual utilizing said healthcare services at said predetermined level within

9   said prospective time span.

1   15. The healthcare management system of claim 11, wherein said plurality of instructions of

2   said memory, when executed by said processor, further cause said processor to

3   generate, based upon a logistic regression formula of said predictive model and said

4   separate values assigned to said set of predictive factors, said risk level of said

5   individual utilizing said healthcare services at said predetermined level within said

6   prospective time span.

1   16. A computer readable medium for a healthcare management system, comprising a

2   plurality of instructions that when executed by said healthcare management system causes

3   said healthcare management system to:

4   assign, based upon information from an individual, a separate value to each predictive

5   factor of a set of predictive factors, and

6   generate, based upon a predetermined predictive model and said separate values

7   assigned to said predetermined set of predictive factors, a risk level of said

8   individual utilizing healthcare services at a predetermined level within a

9   prospective time span.

1   17. The computer readable medium of claim 16, wherein said plurality of instructions, when

2   executed by said healthcare management system, causes said healthcare management system

3   to:

4   present said individual with a questionnaire designed to elicit said information from

5   said individual for said predetermined set of predictive factors, said predetermined

6   set of predictive factors consisting of past healthcare use factors, demographic

7   factors, perceived health factors, disease factors, healthcare compliance factors,

8   healthcare belief factors, healthcare preference factors.

18. The computer readable medium of claim 16, wherein said plurality of instructions, when executed by said healthcare management system, causes said healthcare management system to:

transmit, to a web browser via a network interface of said healthcare management system, a questionnaire designed to elicit said information from said individual, and

receive, via said web browser and said network interface, said information from said individual in response to transmitting said questionnaire.

19. The computer readable medium of claim 16, wherein said plurality of instructions, when executed by said healthcare management system, causes said healthcare management system to:

determine, based upon said risk level for said individual, whether a high risk exists that said individual utilizing said healthcare services at said predetermined level within said prospective time span, and

determine, based upon said information from said individual, at least one intervention program for said individual in response to determining said high risk exists that said individual utilizing said healthcare services at said predetermined level within said prospective time span.

20. The computer readable medium of claim 16, wherein said plurality of instructions, when executed by said healthcare management system, causes said healthcare management system to:

determine, based upon said information, whether each predictive factor of said set of predictive factors is indicative of a high risk of said individual utilizing said healthcare services at said predetermined level within said prospective time span;

assign, based upon said information, a separate first dichotomous value to each said separate value of each predictive factor of said set of predictive factors that said determining step determines is indicative of said high risk of said individual utilizing said healthcare services at said predetermined level within said prospective time span; and

assign, based upon said information, a separate second dichotomous value to each said separate value of each predictive factor of said set of predictive factors that said

14   determining step determines is not indicative of said high risk of said individual

15   utilizing said healthcare services at said predetermined level within said

16   prospective time span, and

17 generate, based upon a logistic regression formula of said predictive model and said

18   separate first dichotomous values and said second dichotomous values assigned to

19   said set of predictive factors, said risk level of said individual utilizing said

20   healthcare services at said predetermined level within said prospective time span.

Abstract of the Disclosure

A healthcare management system and method identify individuals at risk of high near-term healthcare use. On step of the method includes collecting information from an individual for a predetermined set of predictive factors. Another step of the method includes assigning, based upon the information from the individual, a separate value to each predictive factor of the predetermined set of predictive factors. The method further includes the step of generating, based upon a predetermined predictive model and the separate values assigned to the predetermined set of predictive factors, a risk level of the individual utilizing healthcare services at a predetermined level within a prospective time span.

FIG. 1

CLIENT COMPUTING DEVICE 202_1

CLIENT COMPUTING DEVICE 202_2

CLIENT COMPUTING DEVICE 202_3

CLIENT COMPUTING DEVICE 202_4

CLIENT COMPUTING DEVICE 202_x

NETWORK 200

HEALTHCARE MANAGEMENT SYSTEM 100

FIG. 2

```
                    ┌─────────────┐
                    │    BEGIN    │
                    └─────────────┘
                           │
                           ▼
              ┌────────────────────────┐
              │   OBTAIN INFORMATION   │      ⟲ 310
              │  FROM AN INDIVIDUAL VIA A │
              │    HEALTH PERCEPTION    │
              │     QUESTIONNAIRE       │
              └────────────────────────┘
                           │
                           ▼
              ┌────────────────────────┐
              │    PROCESS OBTAINED     │      ⟲ 330
              │  INFORMATION AND ASSIGN │
              │   SUITABLE VALUES TO THE │
              │    PREDICTOR VARIABLES  │
              └────────────────────────┘
                           │
                           ▼
              ┌────────────────────────┐
              │    CALCULATE A VALUE    │      ⟲ 340
              │ INDICATIVE OF WHETHER THE │
              │  INDIVIDUAL IS AT RISK OF HIGH │
              │  NEAR-TERM HEALTHCARE USE │
              └────────────────────────┘
                           │
                           ▼
              ┌────────────────────────┐
              │ DETERMINE RISK LEVEL OF THE │  ⟲ 350
              │   INDIVIDUAL BASED UPON │
              │    CALCULATED VALUE     │
              └────────────────────────┘
                           │
                           ▼
              ┌────────────────────────┐
              │    OUTPUT RESULTS OF    │      ⟲ 360
              │ QUESTIONNAIRE ANAYLYSIS │
              └────────────────────────┘
                           │
                           ▼
                    ┌─────────────┐
                    │     END     │
                    └─────────────┘
```
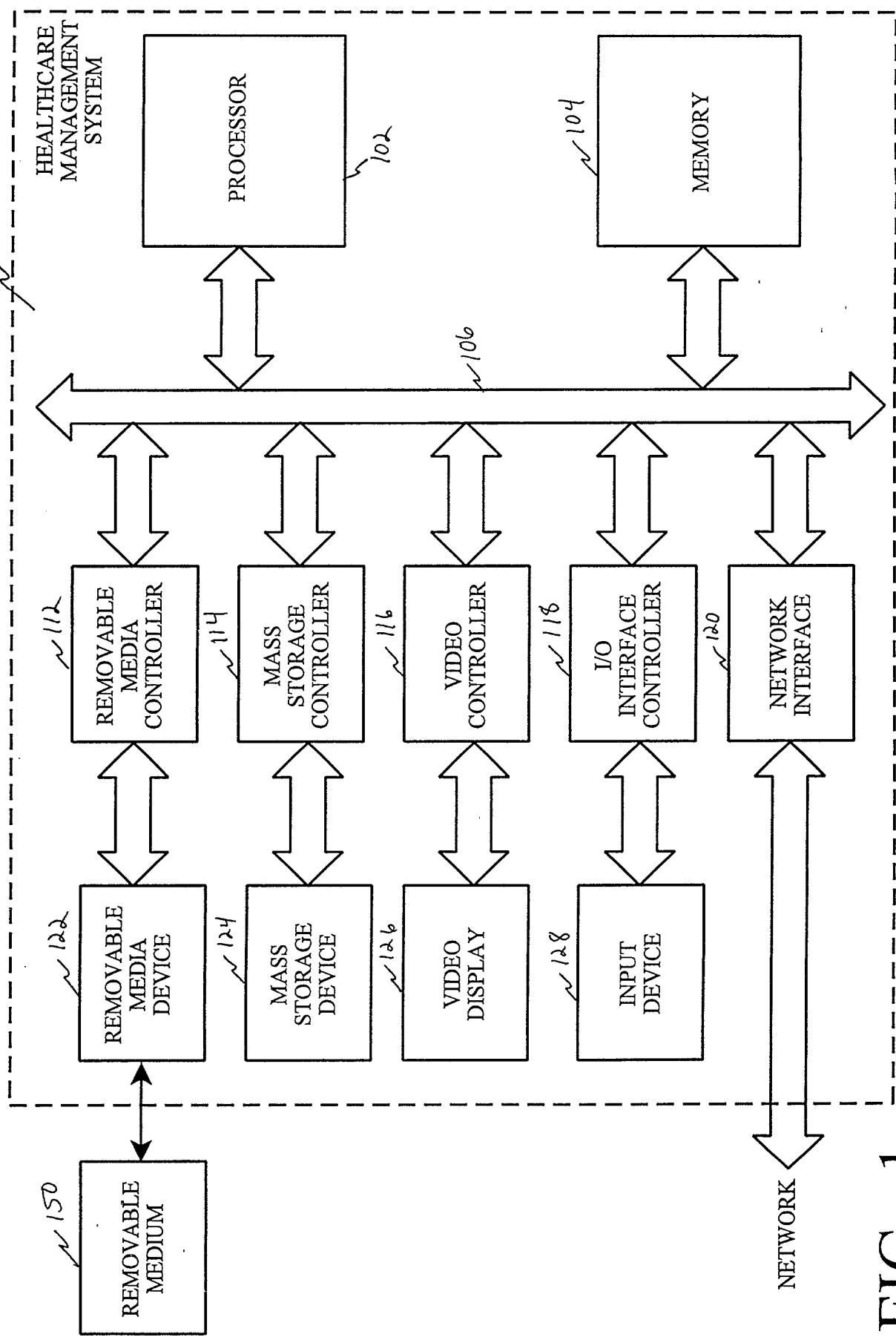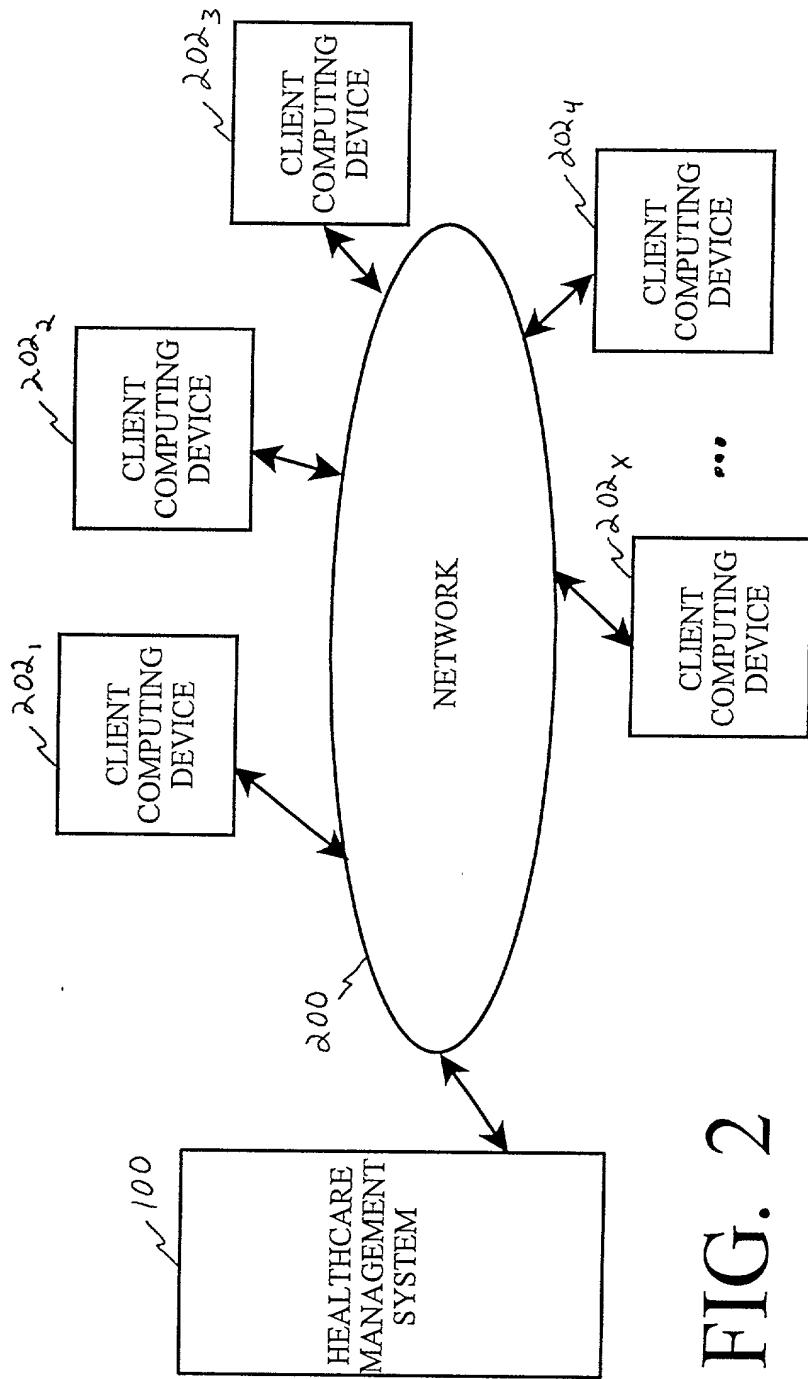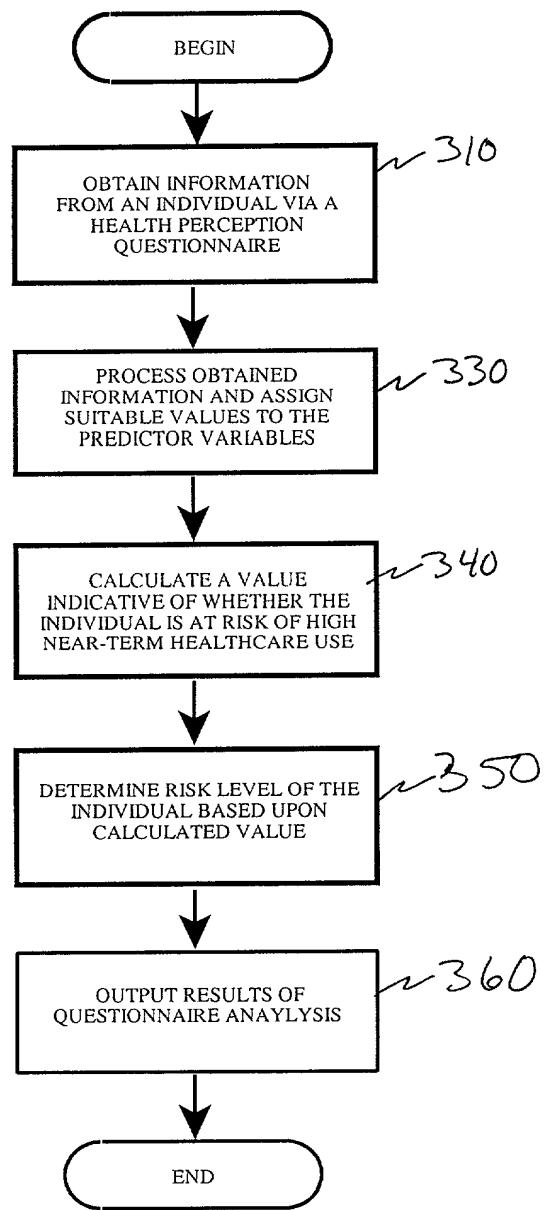
FIG. 3

DECLARATION AND POWER OF ATTORNEY -- PATENT APPLICATION

As below named inventor, I hereby declare that I believe I am the original, first and sole inventor (*if only one name is listed below*) or an original, first and joint inventor (*if plural names are listed below*) of the subject matter which is claimed and for which a patent is sought in the application entitled: HEALTHCARE MANAGEMENT SYSTEM AND METHOD OF PREDICTING HIGH UTILIZERS OF HEALTHCARE SERVICES the specification of which

(*check one*)   __X__ is attached hereto

_____ was filed on _____ as

United States Application Serial No._____ or

PCT International Application No. _____

and was amended on _____ *(if applicable)*.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to herein.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? YES	NO
		▪	☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐

Additional foreign application numbers are listed on a supplemental priority data sheet attached hereto.

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)	
		☐ Additional provisional application numbers are listed on a supplemental priority data sheet attached hereto.

I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application or PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (If applicable)

As a named inventor, I hereby appoint James A. Coles, Reg. No. 28,291; E. Victor Indiano, Reg. No. 30, 143; Timothy E. Niednagel, Reg. No. 33,266; R. Trevor Carter, Reg. No. 40,549; Jeffery B. Huter, Reg. No. 41,086; Anthony P. Filomena, Reg. No. 44,108; Norman J. Hedges, Reg. No. 44,151; and Paul E. Franz, Reg. No. P45,910; as attorneys of record, and William S. Meyers, Reg. No. 42,884 as agent of record, with full power of substitution and revocation, to prosecute this application, and to transact all business in the Patent and Trademark Office connected therewith, and I specify that communications regarding the application be directed to:

> Intellectual Property Group
> Bose McKinney & Evans LLP
> 135 North Pennsylvania Street, Suite 2700
> Indianapolis, Indiana 46204
> Telephone: (317) 684-5000
> Facsimile: (317) 684-5173

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Julie A. Meek
Full Name of Sole or First Joint Inventor

Julie A Meek
Inventor's signature

1925 Fox Moor Terrace

Greenwood, Indiana 46143
Residence and Post Office Address

USA
Country of Citizenship

3-8-00
Date

Brenda L. Lyon
Full Name of Second Joint Inventor

Brenda L. Lyon
Inventor's signature

6563 Calais Circle

Indianapolis, Indiana 46220
Residence and Post Office Address

USA
Country of Citizenship

3/7/00
Date

Wendy D. Lynch
Full Name of Third Joint Inventor

Wendy D. Lynch
Inventor's signature

14281 W. Evans Circle

Lakewood, Colorado 80228
Residence and Post Office Address

USA
Country of Citizenship

3/7/00
Date

268669

- 2 -

HEALTH PERCEPTION QUESTIONNAIRE

Part One: Tell us how you're feeling and doing

Please complete each section.
We want to ask you:

> How you are feeling and doing–compared with how you *expect to be* feeling and doing. Health is experienced as some level of illness or wellness. For example, a person can feel "well", that is be feeling good and doing what they are usually able to do, even though he or she may have a disease like diabetes or heart disease. At other time, a person who does not have a disease can feel "ill".

Tell us how you're doing

1) Think about your normal ability to do things. **How have you been able to do things IN THE PAST MONTH?** (Your "normal" ability is what you are usually able to do.)

> Response box: 1,2,3,4, and 5
> 1 = A lot less than my normal ability
> 2 = A little less than my normal ability
> 3 = At my normal ability
> 4 = A little above my normal ability
> 5 = Quite a bit better than my normal ability

X_{38}

a) Physical ability (for example, walk, walk up stairs, vacuum, care for self, lift objects, mow lawn)

b) Mental ability (for example, think, learn new things, solve problems, make decisions)

c) Social ability (for example, get along with others, enjoy social activities, talk with others, meet your role responsibilities)

d) Spiritual ability (for example, have a sense of meaning or purpose in life, have a sense of inner peace)

X_7

e) Personal needs ability (for example, spend time with family, sleep/rest, and leisure/free time activities)

2) To what extent has "feeling stressed" affected your ability to function overall in the areas listed above?

X_8

> 0 = Have not felt stressed
> 1 = Have felt stressed, but has not limited my ability
> 2 = Have felt stressed, and has slightly limited my ability
> 3 = Have felt stressed, and has moderately limited my ability
> 4 = Have felt stressed, and has greatly limited my ability

Tell us how you're feeling

Your physical symptoms

1) This question is about whether you are feeling any of the physical symptoms listed below. First, review the list below and if you have *not felt* any of the symptoms DURING THE PAST MONTH, mark the response below and move on to Question 1 on the next page.

      o I have *not felt* any of the symptoms listed below DURING THE PAST MONTH.

Next, for every symptom you have felt DURING THE PAST MONTH, please mark:1) How often you have had each symptom, and 2) How much discomfort you have had from each symptom.

It is only necessary to mark those symptoms you are feeling - LEAVE ALL OTHER SYMPTOMS BLANK.

	A multiplied by B	
Symptom	How often have you felt this discomfort? 1 = Rarely felt 2 = Sometimes felt 3 = Frequently felt 4 = Constantly felt	How much discomfort have you had? 1 = Slight discomfort 2 = Mild discomfort 3 = Moderate discomfort 4 = Extreme discomfort
a) Change in urination habits		
b) Chest pain/chest discomfort		
c) Dizziness/light headedness		
d) Drowsiness		
e) Frequent back pain		
f) Frequent coughing/wheezing		
g) Headache		
h) Indigestion		
i) Nausea/vomiting		
j) Obvious change in a mole		
k) Pain other than chest or back paid (including cramping, aching)		
l) Passing blood in stool		
m) Persistent constipation		
n) Persistent diarrhea		
o) Shortness of breath/difficulty breathing		
p) Skin sore that doesn't heal		
q) Thickening or lump in breast		
r) Tired/fatigued/weakness		
s) Trouble with vision (even while wearing glasses or contacts)		
t) Unexplained weight loss of more than 10 lbs.		
u) Unusual bleeding or discharge		

X_{17} (at row d)

X_{15} (at row h)

X_{16} (at row n)

X_{14} (at row r)

Your medical conditions and how you care for yourself

1) This question is about whether you currently have any of the medical conditions listed below. First, review the list below and if you do not have any of the medical conditions listed, mark the response below and move on to Question 2 on this page. (unmarked=0, marked=1)

X_{19} O I *do not have* any of the medical conditions listed below.

It is only necessary to mark those medical conditions you currently have -- please mark ALL that apply - LEAVE ALL OTHERS BLANK.

X_{21}

- O   a) Allergies
- O   b) Arthritis
- O   c) Asthma
- O   d) Cancer
- O   e) Cataracts
- O   f) Chronic back problems

X_{23}

- O   g) Chronic lung disease
- O   h) Coronary heart disease, congestive heart failure, angina, heart attack, or heart surgery
- O   i) Deafness
- O   j) Depression

X_{20}

- O   k) Diabetes or high blood sugar
- O   l) High blood cholesterol of 240 or higher

X_{22}

- O   m) High blood pressure of 140/90 or higher
- O   n) Kidney disease
- O   o) Osteoporosis
- O   p) Psychiatric illness other than depression
- O   q) Seizures or epilepsy
- O   r) Stroke
- O   s) Ulcer or bowel/stomach bleeding

X_{24}

- O   t) Other _____ (please print clearly)

2)   Overall, how adequately do you feel you are managing your medical condition(s)? (Managing your medical condition(s) adequately means that you understand your condition and participate in your care.) Choose only one.
0 =   I do not currently have a medical condition(s), so this question does not apply to me.
1 = More than adequately
2 = Adequately
3 = Somewhat adequately
4 = Not at all adequately

X_{25} 3)   When given long-term medication, which statement is most like you? Choose only one.
0 =   I have never been given long-term medication, so this question does not apply to me.
1 = I give myself reminders so I remember to take the medicine
2 = I usually remember on my own
3 = I don't pay much attention unless I get worse
4 = I often forget to take my medicine
5 = I sometimes stop taking my medicine on my own
6 = I usually don't take the medicine at all.

4) How adequately do you feel you are currently managing your long-term medication(s)? (Managing your medication(s) adequately means that you understand how to take your medicine and you report how you're doing to your doctor.) Choose only one.

0 = I am not currently on any long-term medication(s), so this question does not apply to me
1 = More than adequately
2 = Adequately
3 = Somewhat adequately
4 = Not at all adequately

Your emotions

1) DURING THE PAST MONTH, how much have you felt each of the following?

0 = Not felt
1 = slightly
2 = Somewhat
3 = Quite a bit
4 = Greatly

X_{12}

a) Afraid
b) Angry
c) Calm

X_{11}

d) Depressed
e) Frustrated

X_{13} f) Guilty
X_{10} g) Happy
X_9 h) Sad

Part Two: Tell us about your health care visits and preferences

Please complete each section.

Your health care visits

X_2 1) How many visits to a family doctor or specialist have you made IN THE PAST 6 MONTHS? (0-99)

X_3 1a) Think about those visits—how many did you initiate because of concerns you had or because you didn't feel well? (0-99)

2) How many visits have you made to the emergency room IN THE PAST 6 MONTHS? (0-99)

X_1 3) How many days have you been in the hospital due to sickness or injury IN THE PAST 6 MONTHS? (0-999)

X_6 4) How many days have you missed work or stayed home because you didn't feel well IN THE PAST 6 MONTHS? (0-999)

Your health care beliefs and preferences

X_{26} 1) Which statement best describes your faith in doctors in general when you are dealing with a medical problem that you aren't sure about? Choose only one.

        1 = I don't believe what doctors tell me at all.
        2 = I believe what doctors tell me is often wrong.
        3 = I'm not sure if doctors are more often right or wrong.
        4 = I believe what doctors tell me is usually right.
        5 = I believe all of what doctors tell me.

X_{27} 2) Which statement best describes your opinion of the effectiveness and safety of medicine in general? Choose only one.

        1 = Most medical treatments have not been proven and might be harmful.
        2 = Many medical treatments may have harmful effects we don't know about.
        3 = Some medical treatments haven't been proven, but most are safe.
        4 = Most medical treatments have been proven to be effective and safe.

3) When facing an important medical issue, how often do you seek information from the following sources?

        0 = Never
        1 = Occasionally
        2 = Sometimes
        3 = Always

        a) Alternative Provider (for example, chiropractor, nutritionist, acupuncturist, etc.)
        b) Computer or Internet-based services
        c) Co-workers
        d) Doctor
        e) Family
        f) Friends
        g) Nurse
X_{28} h) Printed materials
X_{29} i) Telephone information services
X_{30} j)Videos

4) Please rate your feelings about the following statements:

        1 = Strongly agree
        2 = Agree
        3 = Disagree
        4 = Strongly disagree

X_{31} a) As you become sicker, you should be told more about your illness.
X_{32} b) Even if the news is bad, you should be well informed
X_{33} c) When you are caring for a family member, it is important to understand everything about their illness and treatment.

X_{35} 5) When you talk to your doctor about a health problem, how much information do you usually receive? Choose only one.
        1 = Less than I would like
        2 = The right amount
        3 = More than I would like

X_{36} 6) For a minor illness, who should be making decisions about your care? Choose only one.
        1 = The doctor alone
        2 = Mostly your doctor
        3 = You and your doctor equally
        4 = Mostly you
        5 = You alone

X_{37} 7) When making a significant decision about health, which statement best describes you. Choose only one.
        1 = I have not yet had to make an important medical care decision.
        2 = I take as much time as I need to get as many opinions as I can and consider all my options carefully before I move ahead.
        3 = I get a few opinions from key people, choose an action and then move ahead.
        4 = I take action as quickly as possible based upon all the information I have at the time

X_{34} 8) How much information would you like to receive about a serious medical problem? Choose only one.
        1 = None
        2 = Very little
        3 = A fair amount
        4 = Quite a lot
        5 = All there is to know

Part Three: Tell us about your health practices and interests.

1) For each statement below, please tell us whether you *already* do or *intend* to do the following health practices. For each statement, please also tell us if you are interested in more information on that topic.

1 = Yes, I have for 5 or more years.
2 = Yes, I have for more than 6 months, but less than 5 years
3 = Yes, I have, but for less than 6 months
4 = No, but I intend to improve in the next 30 days
5 = No, but I intend to improve in the next 6 months
6 = No, and I do not intend to improve in the next 6 months
Check box: I am interested in more information on this topic

With respect to your overall lifestyle, do you...

X_{18}
a) Wear seat belts whenever you are in a motor vehicle?
b) Have your blood pressure checked regularly?
c) Have your blood cholesterol checked regularly?
d) Get regular health exams appropriate for your gender and age? (Examples are: mammograms, pap smears, prostate, rectal exams)
e) Use self-care information to avoid unnecessary doctor visits?
f) Watch your body for the seven warning signs of cancer?
g) Avoid eating high-fat foods?
h) Avoid being overweight for your height and frame size?
i) Exercise moderately at least three times a week for 30 minutes?
j) Avoid smoking or tobacco use? (If you have never smoked, mark 1)
k) Get 7 to 8 hours of sleep most days?
l) Use measures to protect your back when lifting heavy objects?
m) Have a working smoke detector near your sleeping area?
n) Have not more than 15 drinks per week if a man or 12 drinks per week if a woman? (If you have never consumed alcohol, mark 1.)
o) Avoid driving after having to much to drink, or riding with such a person?
p) Avoid using drugs to relieve stress or to alter sleep or for recreational use? (If you have never used drugs for these reasons, mark 1.)

q) Have people in your life you can call upon to share problems with or to get help if needed?
r) Cope well with stress on a regular basis?
s) Deal well with emotions such as anxiety, fear, guilt, frustration or anger?
t) Generally find meaning in your life?

Part Four: Tell us about yourself

It is very important that you accurately complete this section.

1) Name (Last Name, First Name, MI.)

2) Personal ID/SS No.

3) Group ID number (if applicable)

4) Today's Date

5) Age (years)

X_4

6) Gender

X_5

        0=male
        1=female

7) Race (Optional)
        1 = White
        2 = Black, African American, Negro
        3 = Asian
        4 = Hispanic
        5 = American Indian or native American
        6 = Pacific Islander
        7 = Other, please print _____

8) Education in Years (Optional)
For example, high school = 12 years; trade school = 13 years; bachelor's degree = 16 years

9) Income (Optional)
        1 = Under $20,000
        2 = $20,000-$39,999
        3 = $40,000-$59,999
        4 = $60,000-$79,999
        5 = $80,000 or more

Appendix B

Table 1. Sample Descriptives: Unweighted and Weighted for Gender				
Characteristics:	**Unweighted**		**Weighted**	
	N	**Percent**	**N**	**Percent**
Total Population:	20,000	100.0%		
Total Respondents:	4,210	21.1%	6,312	
Gender				
• Male	1,043	24.8%	3,129	49.6%
• Female	3,159	75.0%	3,159	50.0%
• Missing	8	.2%	24	.4%
Age				
• Mean age	45.3		46.4	
• Median age	46.1		47.3	
• Std. Deviation	10.4		10.3	
• Age range	18.8 – 65.2		18.8-65.2	
• Missing	8		24	
Ethnicity				
• White	3,499	83.1%	5,239	83.0%
• Black, African American, or Negro	273	6.5%	401	6.4%
• Asian				
• Hispanic	22	.5%	38	.6%
• American Indian or Native American	146	3.5%	228	3.6%
• Other	18	.4%	36	.6%
• Missing				
	38	.9%	56	.9%
	214	5.1%	314	5.0%
Education				
• Mean years of education	14.4		14.4	
• Median years of education	14.0		14.0	
• Std. Deviation	2.7		2.8	
• Education range	0-30		0-30	
Percentiles				
25th	12.0		12.0	
50th	14.0		14.0	
75th	16.0		16.0	
• Missing	257		383	
Subsequent 6 month Total Encounters				
• Mean	8.5		8.4	
• Median	6.0		6.0	
• Std. Deviation	8.7		8.9	
• Range	1-128		1-128	
Percentiles				
25th	3.0		3.0	
50th	6.0		6.0	
75th	11.0		10.0	

Subsequent 6 month Total Claims Dollars				
• Mean	$832		$858	
• Median	$237		$230	
• Std. Deviation	$2,329		$2,495	
• Range	$0-$56,821		$0-$56,821	
Percentiles				
25th	$102		$98	
50th	$237		$230	
75th	$630		$631	

Table 2. Logistic Model of Predictors of the Probability Of Becoming a High Encounter User within Six Months					
		Predictor Variable Assignment			
Predictors:	Original Range	Variable	Assign 1	Assign 0	Regression Coefficient	Coefficient Value
Past care use predictors:						
• Hospitalized in the past 6 months	0-999	X_1	2-999	0-1	β_1	.4665
• Visits to physician in the past 6 months	0-99	X_2	6-99	0-5	β_2	.8483
• Visits to physician initiated by member because of concerns	0-99	X_3	5-99	0-4	β_3	-.2624
Demographic predictors:						
• Age	0-199	X_4	0-199			
60.0001 or more years					β_4	0
50.0001-60 years					β_4	-.2986
40.0001-50 years					β_4	-.4798
30.0001-40 years					β_4	-.7207
30 or less years					β_4	-.6724
• Gender	0-1	X_5	1	0	β_5	.4115
• Absence from work in past 6 months	0-999	X_6	2-999	0-1	β_6	.2326
Perceived Health predictors:						
• Level of personal functioning	1-5	X_7	1	2-5	β_7	-.3915
• Feeling stressed	0-4	X_8	0-2	3-4	β_8	4262
• Feeling Sad	0-4	X_9	2-4	0-1	β_9	-.2154
• Feeling Happy	0-4	X_{10}	0-1	2-4	β_{10}	.2038
• Feeling Depressed	0-4	X_{11}	2-4	0-1	β_{11}	-.3643
• Feeling Afraid	0-4	X_{12}	2-4	0-1	β_{12}	.2681
• Feeling Guilty	0-4	X_{13}	2-4	0-1	β_{13}	-.3581
• Tiredness	0-16	X_{14}	0-8	9-16	β_{14}	.6502
• Indigestion	0-16	X_{15}	0-8	9-16	β_{15}	.4265
• Diarrhea	0-16	X_{16}	0-8	9-16	β_{16}	.5226
• Drowsiness	0-16	X_{17}	0-8	9-16	β_{17}	-.7959
Disease/compliance predictors:						
• Regular blood pressure checks	1-6	X_{18}	4-6	1-3	β_{18}	-.4244
• No disease conditions	0-1	X_{19}	0	1	β_{19}	-.4186
• Diabetes	0-1	X_{20}	1	0	β_{20}	.8025
• Arthritis	0-1	X_{21}	1	0	β_{21}	-.1828
• Hypertension	0-1	X_{22}	1	0	β_{22}	-.2132
• Chronic lung disease	0-1	X_{23}	1	0	β_{23}	.4641
• Other diseases	0-1	X_{24}	1	0	β_{24}	.2071
• Medication compliance	0-6	X_{25}	0-2	3-6	β_{25}	-.5362
Belief/Preference predictors:						
• Faith in the care system	1-5	X_{26}	1-3	4-5	β_{26}	3306
• Effectiveness and safety of care	1-4	X_{27}	1-2	3-4	β_{27}	.2235
• Seek information from printed material	0-3	X_{28}	0-1	2-3	β_{28}	.1441
• Seek information from phone information services	0-3	X_{29}	0-1	2-3	β_{29}	-.3793
• Seek information from videos	0-3	X_{30}	0-1	2-3	β_{30}	-.6228

Table 2. Logistic Model of Predictors of the Probability Of Becoming a High Encounter User within Six Months.						
		Predictor Variable Assignment				
Predictors:	Original Range	Variable	Assign 1	Assign 0	Regression Coefficient	Coefficient Value
• Told more as you become sicker	1-4	X_{31}	3-4	1-2	β_{31}	.3322
• Well informed even if bad news	1-4	X_{32}	3-4	1-2	β_{32}	1.9274
• Should have treatment information when caring for family member	1-4	X_{33}	3-4	1-2	β_{33}	-1.0287
• Preference for amount of information for serious medical problem	1-5	X_{34}	1-3	4-5	β_{34}	1.8249
• Preference for amount of information received from doctor	1-3	X_{35}	1,3	2	β_{35}	-.1790
• Who should make care decisions with minor illness	1-5	X_{36}	1,5	2-4	β_{36}	-.4005
• Time to make significant health decision	1-4	X_{37}	2-4	1	β_{37}	-.2932
Interaction predictors:						
• Age by level of physical functioning	1-5	X_{38}	1	2-5		
60.0001 or more years					β_{38}	0
50.0001-60 years					β_{38}	.7472
40.0001-50 years					β_{38}	.4277
30.0001-40 years					β_{38}	1.3903
30 or less years					β_{38}	.0424
• Hospitalization by visits to physician					β_{39}	-1.5563
Constant					C	1.1724

Table 3. Results of Chi Square for Predicted vs. Observed Care Use Groups for Split-Half-1				
		Predicted care use groups		Total
Observed care use groups		Low (0)	High (1)	
Low (0)	Count	769	689	1458
	% Within observed group	52.7%	47.3%	100.0%
	% Within predicted group	62.9%	36.5%	46.9%
	% Of Total	24.7%	22.2%	46.9%
High (1)	Count	454	1197	1651
	% Within observed group	27.5%	72.5%	100.0%
	% Within predicted group	37.1%	63.5%	53.1%
	% Of Total	14.6%	38.5%	53.1%
Total	Count	1223	1886	3109
	% Within observed group	39.3%	60.7%	100.0%
	% Within predicted group	100.0%	100.0%	100.0%
	% Of Total	39.3%	60.7%	100.0%

Table 4. ANOVA: Differences in Care Use between Predicted High vs. Low Risk Groups						
		Sum of Squares	df	Mean Square	F	Sig.
Encounters	Between groups	10047.02	1	10047.02	130.024	.000
	Within groups	487578.09	6310	77.271		
	Total	497625.11	6311			
Dollars	Between groups	1.38E+08	1	137655738.62	22.179	.000
	Within groups	3.92E+10	6310	6206462.045		
	Total	3.93E+10	6311			
		High-Risk Group (Weighted) (N=3,778)		Low-Risk Group (Weighted) (N=2,534)		
• Encounters over six months (mean)		9.41		6.83		
• Dollars over six months (mean)		$979.29		$678.03		